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| **Rakesh Kumar** |
| **Chapter-12**  **Electricity**  **Topics to be covered**  **Electric current, potential difference and electric current. Ohm’s law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.** |

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**“Facts are not science — as the dictionary is not literature.”**

**Martin H. Fischer**

**Electricity**

Various phenomena which are related to the presence and flow of electric charge come under electricity. Electric charge is a physical property of matter which causes the matter to experience a force when placed in an electromagnetic field. The flow of electric charge is called electric current. Resistance is an important property of matter and it explains the relative ease or difficulty by which electric current can pass through a matter. Ohm’s Law explains the relation between electric current and resistance. Resistances can be combined in two combinations, viz. series and parallel. Parallel combination is used for most of the purposes, while series combination is used for some special purposes.

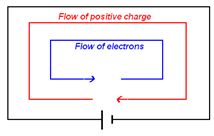
**Electric Current and Electric Circuit**

**Electric Current:** The flow of electric charge is known as electric current. Electric current is carried by moving electrons through a conductor.

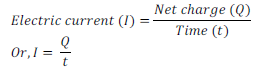
By convention, electric current flows in opposite direction to the movement of electrons.

**Electric Circuit:** Electric circuit is a continuous and closed path of electric current.

**Expression of Electric Current:** Electric current is denoted by letter ‘I’. Electric current is expressed by the rate of flow of electric charges. Rate of flow means the amount of charge flowing through a particular area in unit time.



If a net electric charge (Q) flows through a cross section of conductor in time t, then;



Where, I is electric current is net charge and t is time in second.

SI unit of Electric Charge and Current:

SI unit of electric charge is coulomb (C).

One coulomb is nearly equal to 6 x 1018electrons. SI unit of electric current is ampere (A). Ampere is the flow of electric charges through a surface at the rate of one coulomb per second. This means if 1 coulomb of electric charge flows through a cross section for 1 second, it would be equal to 1 ampere.

Therefore; 1 A = 1 C/1 s

**Small quantity of Electric Current:** Small quantity of electric current is expressed in milliampere and microampere. Milliampere is written as mA and microampere as μA

1mA (milliampere)= 10−3 A

1μA(microampere)=10−6 A

**Ammeter:** An apparatus to measure electric current in a circuit.

Example 1: Find the amount of electric charge flowing through the circuit if an electric current of 5 A is drawn by an electric appliance for 5 minute.

**Solution:** Given, electric current (I) = 5 A

Time (t) = 5 minute = 5 X 60 = 300 s

Electric charge (Q) =?

We know; I = Q/t

Or, Q = I x t

Or, Q = 5 A x 300 s = 1500 C

Example 2: If a current of 2 ampere is drawn for 1 hour through the filament of a bulb, find the amount of electric charge flowing through the circuit.

**Solution:** Given, electric current (I) = 2 A

Time (t) = 1 hour = 1 x 60 x 60 s = 3600 s

Electric charge (Q) =?

We know that Q = I x t

Therefore, Q = 2 A x 3600 s = 7200 C

Example 3: In how much time 6000 coulomb of electric charge will flow, if an electric current of 10 A is drawn through an electric motor?

**Solution:** Given, electric charge (Q) = 6000 C

Electric current (I) = 10 A

Time (t) =?

We know; I = Q/t

Or, t = Q/I

Or, t = 6000 C ÷ 10 A = 600 s

Or, t = 10 min

Example 4: If an electric charge of 900 C flows through an electric bulb for half an hour, find the electric current drawn by the filament.

**Solution:** Given, electric charge (Q) = 900 C

Time (t) = Half an hour = 30 m = 30 x 60 = 1800 s

Electric current (I) =?

We know; I = Q/t

Or, I = 900 C ÷ 1800 s = 0.5 A

Example 5: If an electric charge of 15000 C flows through an electric iron for 5 minute, find the electric current drawn by filament of electric iron.

**Solution:** Given, electric charge (Q) = 1500 C, Time (t) = 5m = 5 x 60 = 300 s

Electric current (I) =?,We know; I = Q/t

Or, I = 1500 C ÷ 300 s = 5 A

**Electric Potential and Potential Difference**

**Electric Potential:** The amount of electric potential energy at a point is called electric potential.

**Electric Potential difference:** The difference in the amount of electric potential energy between two points in an electric circuit is called ELECTRIC POTENTIAL DIFFERENCE.

Electric potential difference is known as voltage, which is equal to the work done per unit charge to move the charge between two points against static electric field.

Therefore;

potential difference formula

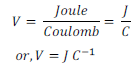
Voltage or electric potential difference is denoted by ‘V’. Therefore;

voltage formula

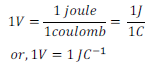
Where, W = work done and Q = Charge

**SI unit of electric potential difference (Voltage):**

SI unit of electric potential difference is volt and denoted by ‘V’. This is named in honour of Italian Physicist Alessandro Volta.



Since joule is the unit of work and coulomb is the unit of charge; 1 volt of electric potential difference is equal to the 1 joule of work to be done to move a charge of 1 coulomb from one point to another in an electric circuit. Therefore,



Voltmeter: An apparatus to measure the potential difference or electric potential difference between two points in an electric circuit.

Example 1: Calculate the work done if a charge of 5 C moving across two point having potential difference equal to 15 V.

**Solution:** Given, potential difference (V) = 15 V

Charge (Q) = 5 C

Work done (W) =?

We know that; V = W/Q

Or, W = V x Q

Or, W = 15 V x 5 C = 75 J

Example 2: Calculate the work done to carry a charge of 3 C, if the potential difference between two points is 10 V.

**Solution:** Given, charge = 3 C

Potential difference between two points = 10V

Work done (W) =?

We know that; V = W/Q

Or, W = V x Q

Or, W = 10 V x 3 C = 30 J

Example 3: What potential difference is required to do 100 J of work to carry a charge of 10 C between two points?

**Solution:** Given, work done (W) = 100J

Charge (Q) = 10C

Potential difference (V) =?

We know that; V = W/Q

Or, V = 100 J ÷ 10 C = 10 V

Example 4: Calculate the potential difference between two points, if 1500 J of work is done to carry a charge of 50C from one point to other?

Solution: Given, work done (W) = 1500J

Charge (Q) = 50C

Potential difference (V) =?

We know that; V = W/Q

Or, V = 1500 J ÷ 50 C = 30 V

Example 5: 5000 J of work would is done to carry how much charge between two points having potential difference of 100 V?

Solution: Given, potential difference (V) = 100V

Work done (W) = 5000 J

Charge (Q) =?

We know that; V = W/Q

Or, Q = W/V

Or, Q = 5000 J ÷ 100 V = 50 C

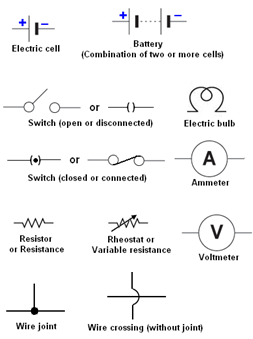
Example 6: To carry how much charge between two points having potential difference equal to 220 V, 1760 J of work is done?

Solution: Given, potential difference (V) = 220V, Work done (W) = 1760 J

Charge (Q) =?,We know that; V = W/Q, Or, Q = W/V

Or, Q = 1760 J ÷ 220 V = 8 C

**Symbols used in a Circuit diagram**

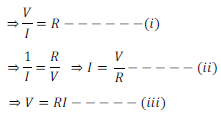


**Ohm's Law**

Ohm’s Law states that the potential difference between two points is directly proportional to the electric current.

This means; potential difference V varies as electric current.

Or, V α I



Where R is constant for the given conductor at a given temperature and called resistance. Resistance is the property of conductor which resists the flow of electric current through it.

**Resistance**

Resistance is a property of conductor due to which it resists the flow of electric current through it. Component that is used to resist the flow of electric current in a circuit is called resistor.

In practical applications, resistors are used to increase or decrease the electric current.

**Variable Resistance:** The component of an electric circuit which is used to regulate the current; without changing the voltage from the source; is called variable resistance.

**Rheostat:** This is a device which is used in a circuit to provide variable resistance.

**Cause of Resistance in a Conductor:**

Flow of electrons in a conductor is electric current. The particles of conductor create hindrance to flow of electrons; because of attraction between them. This hindrance is the cause of resistance in the flow of electricity.

Resistance in a conductor depends on nature, length and area of cross section of the conductor.

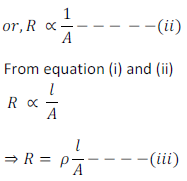
**Nature of material:** Some materials create least hindrance and hence are called good conductors. Silver is the best conductor of electricity. While some other materials create more hindrance in the flow of electric current, i.e. flow of electrons through them. Such materials are called bad conductors. Bad conductors are also known as insulators. Hard plastic is the one of the best insulators of electricity.

**Length of conductor:** Resistance R is directly proportional to the length of the conductor. This means, Resistance increases with increase in length of the conductor. This is the cause that long electric wires create more resistance to the electric current.

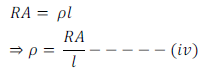
Thus, Resistance (R) ∝ length of conductor (l)

Or R ∝ l --------(i)

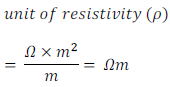
Area of cross section: Resistance R is inversely proportional to the area of cross section (A) of the conductor. This means R will decrease with increase in the area of conductor and vice versa. More area of conductor facilitates the flow of electric current through more area and thus decreases the resistance. This is the cause that thick copper wire creates less resistance to the electric current.Thus, resistance ∝ 1/Area of cross section of conductor (A)



Where ρ (rho) is the proportionality constant. It is called the **electrical resistivity** of the material of conductors.From equation (iii)



**The SI unit of resistivity:** Since, the SI unit of R is Ω, SI unit of Area is m2 and SI unit of length is m. Hence



Thus, SI unit of resistivity (ρ) is Ω m

Materials having resistivity in the range of 10−8 Ω m to 10−6 Ω m are considered as very good conductors. Silver has resistivity equal to 1.60 X 10−8 Ω m and copper has resistivity equal to 1.62 X 10−8 Ω m.

Rubber and glass are very good insulators. They have resistivity in the order of 1012 Ω m to 1017 Ω m.

Resistivity of materials varies with temperature.

Example 1: What will be the resistivity of a metal wire of 2 m length and 0.6 mm in diameter, if the resistance of the wire is 50 Ω.

**Solution:**

Given, Resistance ( R ) = 50 Ω, Length ( l ) = 2 m

Diameter = 0.6 mm

Hence, radius = 0.3 mm = 3 x 10−4 m

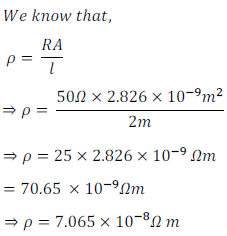
Resistivity (ρ) = ?

Now, area of cross section of wire = π r2

Or, A = 3.14 x (3 x 10−4)2

Or, A = 28.26 x 10−8 m2

= 2.826 x 10−9 m2



Example 2: The resistance of an electric wire of an alloy is 10 Ω. If the thickness of wire is 0.001 meter, and length is 1 m, find its resistivity.

**Solution:** Given, Resistance ( R ) = 10 Ω, Length ( l ) = 1 m

Diameter = 0.001 m

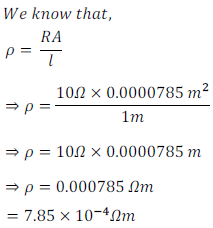
Therefore, radius = 0.0005 m

Resistivity (ρ) =?

Now, area of cross section of wire = π r2

Or, A = 3.14 x (0.005)2 m2

Or, A = 0.00007850 m2



Example 3: The resistivity of a metal wire is 10 x 10−8 Ω m at 20°C. Find the resistance of the same wire of 2 meter length and 0.3 mm thickness.

**Solution:** Given, Resistivity (ρ) = 10 x 10−8Ω m, Length ( l ) = 2 m, Diameter = 0.3 mm

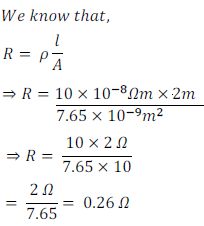
Resistance (R) =?

Now, Radius of wire = Diameter / 2 = 0.3 mm / 2 = 0.15 mm = 1.5 x 10−5 m

Now, area of cross section of wire = π r2

Or, A = 3.14 x (1.5 x 10−5)2

Or, A = 70.65 x 10−10 m2



Example 4: The area of cross section of wire becomes half when its length is stretched to double. How the resistance of wire is affected in new condition?

**Solution:** Let the area of cross section of wire = A

Let length of wire before stretching = L

Let Resistance of wire = R

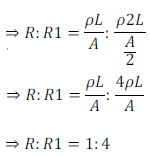
After stretching of wire, let

Area of cross section = A / 2

Length = 2L

Resistance = R1

Thus, ratio of resistance before stretching to resistance after stretching can be given as follows:



This means R = 1 and R1 = 4

Thus, resistance increases four times after stretching of wire.

**Resistance: Part 2**

Resistance Of A System of Resistors:

Resistors are joined in two ways, i.e. in series and in parallel.

**Resistors in Series:** When resistors are joined from end to end, it is called in series. In this case, the total resistance of the system is equal to the sum of the resistance of all the resistors in the system.

Let total resistance = R

Resistance of resistors are R1, R2, R3, …Rn

Therefore, R = R1 + R2 + R3 + …………+ Rn

**Resistors in parallel:** When resistors are joined in parallel, the reciprocal of total resistance of the system is equal to the sum of reciprocal of the resistance of resistors.

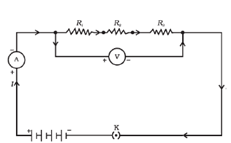


Fig: Resistance in Series

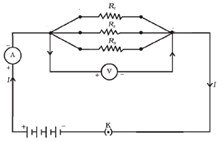


Fig: Resistance in Parallel

Let total resistance = R

Resistances of resistors are R1, R2, R3, … Rn

sum total resistance in parallel

Example 1: There are three resistors joined in series in a system having resistance equal to 10 Ω, 20 Ω and 30 Ω respectively. If the potential difference of the circuit is 240 V, find the total resistance and current through the circuit.

**Solution:** Given, R1 = 10 Ω, R2 = 20 Ω, R3= 30 Ω and V = 240 V

Total resistance (R) =?

Current through the circuit ( I ) =?

According to Ohm’s Law Total resistance in series (R) = Sum of resistance of all resistors

Or, R = 10 Ω + 20 Ω + 30 Ω = 60 Ω

We know that electric current I = V/R

Or, I = 240 V ÷ 60 Ω = 4 A

Thus, total resistance (R)= 60 Ω

Current through the circuit = 4 A

Example 2: There are two electric lamps M and N which are joined in a series having resistance equal to 15 Ω and 20 Ω respectively. If the potential difference between two terminals of electric circuit is 220V, find the total resistance and electric current through the circuit. Also find the potential difference across the two lamps separately.

**Solution:** Given, resistance (R1) of one electric lamp, M = 15.2 Ω

Resistance (R2) of other electric lamp, N = 20 Ω

Potential difference (V) through the circuit = 220 V

Electric current (I) through the circuit =?

Potential difference through each of the electric lamp =?

According to Ohm’s Law; total resistance in series

= Sum of resistance of all resistors = 15.2 Ω + 20 Ω = 35.2 Ω

Electric Current I = V/R = 220 V ÷ 35.2 Ω = 6.25 A

Potential difference (V1) across electric lamp M = 15.2 Ω ÷ 6.25 A = 2.432 V

Potential difference (V2) across electric lamp N = 20 Ω ÷ 6.25 A = 3.2 V

Thus, electric current through the circuit = 6.25 A

Potential difference through electric lamp M = 2.432 V

Potential difference through electric lamp N = 3.2 V

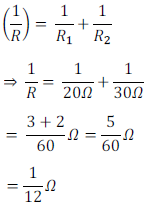
Example 3: There are two resistors R1 and R2 having resistance equal to 20Ω and 30Ω respectively are connected in parallel in an electric circuit. If the potential difference across the electric circuit is 5 V, find the electric current flowing through the circuit and the total resistance of the resistors.

**Solution:** Given, R1 = 20 Ω, R2 = 30 Ω, Potential difference (V) = 5 V

Total resistance (R) =?

Electric current (I) through the circuit =?

We know that in parallel combination, the reciprocal of total resistance is;



Now, electric current through the circuit I = V/R

Or, I = 5 V ÷ 12 Ω = 0.416 A

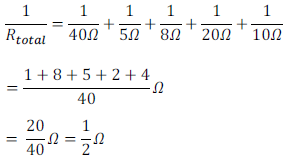
Thus, total resistance R = 12 Ω

Electric current (I) through the circuit = 0.416 A

Example 4: There are five electric appliances, viz. electric heater and electric lamp, an electric fan, computer and an exhaust fan are connected in parallel in a household. The resistance electric appliances are 40Ω, 5 Ω, 8Ω, 20Ω and 10Ω respectively. If an electric current of 240V is flowing through the circuit then find

1. Total resistance through the circuit
2. Total electric current (I) through the circuit and
3. The current through each of the resistor.

**Solution:** We know that the recpirocal of total resistance = sum of reciprocals of individual resistances



Or, Rtotal = 2 Ω

Now, electric current through the circuit = V/R, Or, I = 240 V ÷ 2 Ω = 120 A

Similarly, electric current through different appliances can be calculated as follows:

Electric current through heater = 240 V ÷ 40 Ω = 6 A

Electric current through electric lamp = 240 V ÷ 5 Ω = 48 A

Electric current through electric fan = 240 V ÷ 8 Ω = 30 A

Electric current through computer = 240 V ÷ 20 Ω = 12 A

Electric current through exhaust = 240 V ÷ 10 Ω + 24 A

The total current through the circuit can be calculated by adding the electric current through individual resistors.

Or, Itotal = 6 A + 48 A + 30 A + 12 A + 24 A = 120 A

**Heating Effect of Electric Current**

When electric current is supplied to a purely resistive conductor, the energy of electric current is dissipated entirely in the form of heat and as a result, resistor gets heated. The heating of resistor because of dissipation of electrical energy is commonly known as Heating Effect of Electric Current. Some examples are as follows:

When electric energy is supplied to an electric bulb, the filament gets heated because of which it gives light. The heating of electric bulb happens because of heating effect of electric current.

When an electric iron is connected to an electric circuit, the element of electric iron gets heated because of dissipation of electric energy, which heats the electric iron. The element of electric iron is a purely resistive conductor. This happens because of heating effect of electric current.

**Cause of heating effect of electric current:** Electric current generates heat to overcome the resistance offered by the conductor through which it passes. Higher the resistance, the electric current will generate higher amount of heat. Thus, generation of heat by electric current while passing through a conductor is an inevitable consequence. This heating effect is used in many appliances, such as electric iron, electric heater, electric geyser, etc.

**Joule’s Law of Heating:**

Let; an electric current I is flowing through a resistor having resistance equal to R.

The potential difference through the resistor is equal to V.

The charge Q flows through the circuit for the time t.

Thus, work done in moving of charge Q of potential difference V = VQ

Since, this charge Q flows through the circuit for time t

Therefor; power input (P) to the circuit can be given by following equation:

joule's law of heating formula

We know, electric current I = Q/t

Substituting Q/t = I in equation (i), we get;

P = VI ..........(ii)

Since the electric energy is supplied for time t, thus after multiplying both sides of equation (ii) by time t, we get

P x t = VI x t = VIt .....(iii)

Thus, for steady current I, the heat produced (H) in time t is equal to VIt

Or, H = VIt.........(iv)

We know; according to Ohm's law; V = IR

By substituting this value of V in equation (iv), we get;

H = IR x It

Or, H = I2Rt ........(v)

The expression (v) is known as Joule’s Law of Heating, which states that heat produced in a resistor is directly proportional to the square of current given to the resistor, directly proportional to the resistance for a given current and directly proportional to the time for which the current is flowing through the resistor.

Example 1: If an electric heater consumes electricity at the rate of 500W and the potential difference between the two terminals of electric circuit is 250V, calculate the electric current and resistance through the circuit.

**Solution:**

Given, power input (P) = 500 W  
Potential difference (V) = 250 V  
Electric current (I) =?  
Resistance (R) through the circuit =?

We know that power (P) = VI

Or, 500 W = 250 V x I

Or, I = 500 W ÷ 250 V = 2 A

We know, resistance R = V/I

Or, R = 250 V ÷ 2 A = 125 Ω

Example 2: An electric geyser consumes electricity at the rate of 1000W. If the potential difference through the electric circuit is 250 V, find the resistance offered by geyser and electric current through the circuit.

**Solution:** Given, power input (P) = 1000 W

Potential difference (V) = 250 V

Electric current (I) =?

Resistance (R) through the circuit =?

We know that power (P) = VI

Or, 1000 W = 250 V x I

Or, I = 1000 V ÷ 250 V = 4 A

We know, resistance R = V/I

Or, R = 250 V ÷ 4 A = 62.5 Ω

Example 3: An electric heater having resistance equal to 5Ω is connected to electric source. If it produces 180 J of heat in one second, find the potential difference across the electric heater.

**Solution:** Given, Resistance (R) = 5 Ω, Heat (H) produced per second by heater = 1800 J, time‘t’ = 1 s

Potential difference (V) =?

To calculate the potential difference, we need to calculate electric current (I) first.

We know that H = I2Rt, Or, 180 J = I2 x 5 Ω x 1 s, Or, I2 = 180 ÷ 5 = 36

Or, I = 6 A

Now, potential difference V = IR

Or, V = 6 A x 5 Ω = 30 V

**Heating Effect of Electric Current-Practical Application**

Practical Application of Heating Effect of Electric Current & Electric Power

For exploiting the heating effect of electric current, the element of appliances must have high melting point to retain more heat. The heating effect of electric current is used in the following applications:

**Electric Bulb:** In an electric bulb, the filament of bulb gives light because of heating effect of electricity. The filament of bulb is generally made of tungsten metal; having melting point equal to 3380°C.

**Electric iron:** The element of electric iron is made of alloys having high melting point. Electric heater and geyser work on the same mechanism.

**Electric fuse:** Electric fuse is used to protect the electric appliances from high voltage; if any. Electric fuse is made of metal or alloy of metals, such as aluminium, copper, iron, lead, etc. In the case of flow of higher voltage than specified, fuse wire melts and protects the electric appliances.

Fuse of 1A, 2A, 3A, 5A, 10A, etc. are used for domestic purpose.

Suppose, if an electric heater consumes 1000W at 220V.

Then electric current in circuit I = P/V

Or, I = 1000 W − 220 V = 4.5 A

Thus, in this case a fuse of 5A should be used to protect the electric heater in the case of flow of higher voltage.

**Electric Power:**

SI unit of electric power is watt (W).

1W = 1 volt x 1 ampere = 1V x 1A

1 kilo watt or 1kW = 1000 W

Consumption of electricity (electric energy) is generally measured in kilo watt.

Unit of electric energy is kilo watt hour (kWh)

1 kWh = 1000 watt X 1 hour = 1000 W x 3600 s

Or, 1kWh = 3.6 x 106 watt second = 3.6 x 106 J

Example 1: If the potential difference is 220V and the power of bulb is 110W, what is the electric current flowing in the circuit?

**Solution:** Given, Potential difference, V = 220V, Power of bulb , P = 110 W

Electric current (I) =?

We know that P = VI

Or, 110 W = 220 V x I

Or, I = 110 W ÷ 220 V = 0.5 A

Example 2: If the power of an electric heater is 1000W and electricity of 240 V is flowing through it, find the electric current in the electric heater.

**Solution:**

Given, Power (P) = 1000W, Potential difference (V) = 240V, Electric current (I) =?

We know that P = VI

Or, 1000 W = 240 V x I

Or, I = 1000 W ÷ 240 V = 4.16 A

Example 3: What is the electric current through an electric geyser of 500W, if the potential difference across the electric circuit is 250V?

**Solution:** Given, P = 500W, V= 250 V, therefore, Electric current (I) =?

We know that P = VI

Or, 500 W = 250 V x I

Or, I = 500 W ÷ 250 V = 2 A

Example 4: If the electric current is 10A and potential different between two terminals is 240V, find the power of the electric appliance.

**Solution:** Given, Electric current (I) = 10A, Potential difference (V) = 240V, Power (P) =?

Since, P = V x I

Therefore, P = 240V x 10A = 2400 W

Example 5: Find the power of electric iron, if electric current through the circuit is 5A and potential difference is 220V.

**Solution:** Given, Electric current (I) = 5 A, Potential difference (V) = 220 V, Power (P) =?

We know that, P = V x I

Or, P = 220 V x 5 A = 1100 W

**Electricity At a Glance**

* Electric Current: The flow of electric charge is known as electric current.
* Electric current is carried by moving electrons through a conductor.
* Electric current flows in the opposite direction of the movement of electrons.
* Electric circuit: Electric circuit is a continuous and closed path of electric current.
* Electric current is denoted by letter ‘I’.
* Electric current is expressed by the rate of flow of electric charges, i.e. amount of charge flowing through a particular area in unit time.
* SI unit of electric charge is coulomb (C). One coulomb is nearly equal to 6 x 1018 electrons.
* SI unit of electric current is ampere (A). Ampere is the flow of electric charges through a surface at the rate of one coulomb per second. 1mA (milliampere)= 10-3 A AND 1μA(microampere)=10-6 A
* Ammeter: An apparatus to measure electric current in a circuit.
* Electric Potential: The amount of electric potential energy at a point is called electric potential.
* Electric Potential difference: The difference in the amount of electric potential energy between two points in an electric circuit is called electric potential difference.
* Electric potential difference is known as voltage, which is equal to the work done per unit charge to move the charge between two points against static electric field. It is denoted by ‘V’.
* Voltmeter: An apparatus to measure the potential difference or electric potential difference between two points in an electric circuit.
* Ohm’s Law: The potential difference between two points is directly proportional to the electric current.
* SI Unit of resistance is ohm. Ohm is denoted by Greek letter ‘Ω’.
* 1 ohm (Ω) of Resistance (R) is equal to the flow of 1 A of current through a conductor between two points having potential difference equal to 1 V.
* Component that is used to resist the flow of electric current in a circuit is called resistor.
* Variable Resistance: The component of an electric circuit which is used to regulate the current; without changing the voltage from the source; is called variable resistance.
* Rheostat: This is a device which is used in a circuit to provide variable resistance.
* Resistance in a conductor depends on nature, length and area of cross section of the conductor.
* Resistance increases with increase in length of the conductor. Resistance decreases with increase in thickness of conductor.
* Resistors in Series: When resistors are joined from end to end, it is called in series. The total resistance of the system is equal to the sum of the resistance of all the resistors connected in series in the system.
* Resistors in parallel: When resistors are joined in parallel, the reciprocal of total resistance of the system is equal to the sum of reciprocal of the resistance of resistors.
* When electric current is supplied to a purely resistive conductor, the energy of electric current is dissipated entirely in the form of heat and as a result, resistor gets heated. The heating of resistor because of dissipation of electrical energy is commonly known as Heating Effect of Electric Current.
* Joule’s Law of Heating: Heat produced in a resistor is directly proportional to the square of current given to the resistor, directly proportional to the resistance for a given current and directly proportional to the time for which the current is flowing through the resistor.
* SI unit of electric power is watt (W).
* 1W = 1 volt x 1 ampere = 1V x 1A
* 1 kilo watt or 1kW = 1000 W
* 1 kWh = 1000 watt x 1 hour = 1000 W x 3600 s ⇒ 1kWh = 3.6 x 106 watt second = 3.6 x 106J